Circular No. 6068,
May, 1928.

INFORMATION CIRCULAR

DEPARTMENT OF COMMERCE - BUREAU OF MINES

DEVELOPMENT AND SAFETY OF THE STORAGE - BATTERY LOCOMOTIVE [1]

By L. C. Ilsley[2]

The underlying principle of the storage battery was discovered within the memory of many still living, hence storage-battery locomotives, which were made possible by this discovery, represent a still more recent development. The Journal of the Franklin Institute for December, 1883, gives an account of the building of an electrical omnibus by The Electrical Storage Battery Co., of Millwall, London. This, if not the first, was among the first attempts to use the storage battery as the source of energy for locomotion.

During the period 1888 to 1893 occasional attempts were made to apply this idea practically, but not much was achieved along useful lines. The progress during the next 15 years was slow, and little success was achieved. Therefore, the last two decades may be considered the successful development period of the storage-battery locomotive.

In coal mining, the application of the storage-battery locomotive is chiefly in gathering service in competition with animal or cable-reel locomotives. The locomotive delivers empty carsto the rooms or working places where the coal is being mined and hauls the loaded cars from the rooms. The length of haul depends upon the distance of the junction point from the active workings of the mine. As a rule the haulage from the junction point to the foot of the shaft or bottom of the slope is done by trolley locomotives, but in some instances where the grades permit this main-line haulage work is performed by storage-battery locomotives.

As the place storage-battery locomotives occupy with respect to safe haulage in gassy mines appears to be misunderstood, it is the purpose of this paper to clarify this point.

Those who originally designed storage-battery locomotives had no thought of safety in mind and it is just as well that they did not, as these early types of storage-battery locomotives with open controller, open motor, open rheostats, flimsy headlights, and crude wiring were very dangerous electrically and not at all suitable for use in a gassy mine. These locomotives, however, were placed in mines in which open lights were permitted and they replaced considerable animal haulage. Later they were gradually introduced in mines where closed lights were used, but in most cases these mines were not extremely gassy.

---

1 This article is not subject to copyright. Reprinting, with customary acknowledgment to the Bureau of Mines, will be welcomed.

2 Electrical engineer, Pittsburgh Experiment Station, U. S. Bureau of Mines.

Digitized by Google

Safety engineers gradually began to consider the possibilities of so changing the design of storage-battery locomotives, which were becoming a standardized product, that they might be used with reasonable safety in gassy mines. A locomotive of this type was visioned as far back as 1915. Representatives of locomotive manufacturers and engineers of the Bureau of Mines cooperated in preparing tentative standards for such equipment, and in November 1919, a formal standard known as Schedule 15 was finally issued.

The first approval under this schedule was issued March 14, 1921. Nearly every manufacturer of locomotive equipment entered the field and designed permissible storage-battery outfits. At present, eight companies have a total of 19 approvals for locomotive equipment. Two manufacturers have approvals for power trucks.

The simplicity and safety of this kind of equipment have improved continuously. Battery-box covers, which were weak, have been materially strengthened and mechanical means adopted for handling these heavier covers. The wiring between accessories has been simplified and better schemes adopted for its mechanical protection. Improved design of battery jars and battery plates has resulted in much longer battery life and in more reliable service. A better understanding of battery installation has resulted in less breakage of jars.

The Bureau of Mines from the first has looked upon the permissible-type storage-battery locomotive with favor because of its inherent safety advantages. That its energy is self-contained and limited to the immediate zone of the locomotive is a safety factor of great importance. In the trolley type of equipment one necessarily uses the track return, and the danger zone from the return corrent may extend throughout the mine. Poor bonding or no bonding may force the return current back toward the face. A storage-battery locomotive does not use or need the dangerous overhead trolley with its constant shock menace and fire hazard, and with the possibility of trolley or feeder circuits becoming a factor in ignition of gas or coal-dust. The trolley is an alleged cause of some very serious disasters. A storage-battery locomotive does not depend upon a trailing cable, a fact again very much in its favor. Although trailing cables have been allowed on permissible equipment, they are a constant source of worry and are the weakest link in the bureau's approval system. Locomotives that depend upon a trailing cable use a trolley pole after they leave the immediate zone covered by the short length of cable. Hence, much of this work produces the trolley arc which is dangerous if gas accidently accumulates anywhere along the trolley wire, as occasionally happens. The permissible-type storage-battery locomotive can operate at any part of a mine with the same factor of safety, and at night or any time when not in operation it can be brought to a point of absolute safety; whereas, with a wired system the wire must be left behind and exposed to all the hazards of roof and timber falls.

In summing up the situation certain facts can be enumerated:

1. Early types of storage-battery locomotives were crude in design and not too satisfactory in operation; also, no attempts were made to make them safe.
2. Such open-type equipment is still unsafe for use in gassy mines.

Digitized by Google

3. Permissible storage-battery locomotives, brought out under the joint endeavors of the locomotive manufacturers and the Bureau of Mines, show great improvement over early designs.
4. Such locomotives have been developed by nearly every locomotive manufacturer and are now available to operators.
5. The permissible storage-battery locomotive offers a high order of safety, and it has certain inherent safety advantages not common to any other type of equipment.
6. The Bureau of Mines strongly advocates the use of permissible storage-battery locomotives for haulage in gassy mines.

* * * * * * * * * * *

Digitized by Google